NASA SP-7037 (352)
July 11, 1997

AERONAUTICAL ENGINEERING

A CONTINUING BIBLIOGRAPHY WITH INDEXES

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Typical Report Citation and Abstract

❶ **19970001126** NASA Langley Research Center, Hampton, VA USA
❷ **Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes**
❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;
❹ Mar. 1996; 130p; In English
❺ Contract(s)/Grant(s): RTOP 505-68-70-04
❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10’ to 50’, and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65’ swept forebody serrations tended to roll together, while vortices from 40’ swept serrations were more effective in generating additional lift caused by their more independent nature.
❽ Author
❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

Key

1. Document ID Number; Corporate Source
2. Title
3. Author(s) and Affiliation(s)
4. Publication Date
5. Contract/Grant Number(s)
6. Report Number(s); Availability and Price Codes
7. Abstract
8. Abstract Author
9. Subject Terms

AERONAUTICAL ENGINEERING

A Continuing Bibliography (Suppl. 352)

JULY 11, 1997

01
AERONAUTICS

19970018295 Logistics Management Inst., McLean, VA USA

Aviation System Analysis Capability (ASAC) Quick Response System (QRS) Test Report

Roberts, Eileen, Logistics Management Inst., USA; Villani, James A., Logistics Management Inst., USA; Ritter, Paul, Logistics Management Inst., USA; Apr. 1997; 182p; In English

Contract(s)/Grant(s): NAS2-14361; RTOP 538-08-11-01

Report No.(s): NASA-CR-201680; LMI-NS601T3; NAS 1.26:201680; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

This document is the Aviation System Analysis Capability (ASAC) Quick Response System (QRS) Test Report. The purpose of this document is to present the results of the QRS unit and system tests in support of the ASAC QRS development effort. This document contains an overview of the project background and scope, defines the QRS system and presents the additions made to the QRS this year, explains the assumptions, constraints, and approach used to conduct QRS Unit and System Testing, and presents the schedule used to perform QRS Testing. The document also presents an overview of the Logistics Management Institute (LMI) Test Facility and testing environment and summarizes the QRS Unit and System Test effort and results.

Author

Technologies; Systems Analysis; Air Transportation; Economic Impact; Aeronautics

19970018388 Logistics Management Inst., McLean, VA USA

The Flight Track Noise Impact Model *Final Report*

Burn, Melissa, Wyle Labs., Inc., USA; Carey, Jeffrey, Wyle Labs., Inc., USA; Czech, Joseph, Wyle Labs., Inc., USA; Wingrove, Earl R., III, Logistics Management Inst., USA; Apr. 1997; 50p; In English

Contract(s)/Grant(s): NAS2-14361; RTOP 538-08-11-01

Report No.(s): NASA-CR-201683; LMI-NS602T3; NAS 1.26:201683; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

To meet its objective of assisting the U.S. aviation industry with the technological challenges of the future, NASA must identify research areas that have the greatest potential for improving the operation of the air transportation system. to accomplish this, NASA is building an Aviation System Analysis Capability (ASAC). The Flight Track Noise Impact Model (FTNIM) has been developed as part of the ASAC. Its primary purpose is to enable users to examine the impact that quieter aircraft technologies and/or operations might have on air carrier operating efficiency at any one of 8 selected U.S. airports. The analyst selects an airport and case year for study, chooses a set of flight tracks for use in the case, and has the option of reducing the noise of the aircraft by 3, 6, or 10 decibels. Two sets of flight tracks are available for each airport: one that represents actual current conditions, including noise abatement tracks, which avoid flying over noise-sensitive areas; and a second set that offers more efficient routing. FTNIM computes the resultant noise impact and the time and distance saved for each operation on the more efficient, alternate tracks. Noise impact is characterized in three ways: the size of the noise contour footprint, the number of people living within the contours, and the number of homes located in the same contours. Distance and time savings are calculated by comparing the noise abatement flight path length to the more efficient alternate routing.

Author

Aircraft Noise; Air Transportation; Noise Reduction; Airports; Aeroacoustics; Models

19970018389 Logistics Management Inst., McLean, VA USA

The ASAC Air Carrier Investment Model (Second Generation) ***Final Report***

Wingrove, Earl R., III, Logistics Management Inst., USA; Johnson, Jesse P., Logistics Management Inst., USA; Sickles, Robin C., Rice Univ., USA; Good, David H., Indiana Univ., USA; Apr. 1997; 78p; In English

Contract(s)/Grant(s): NAS2-14361; RTOP 538-08-11

Report No.(s): NASA-CR-201678; LMI-NS602T1; NAS 1.26:201678; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

To meet its objective of assisting the U.S. aviation industry with the technological challenges of the future, NASA must identify research areas that have the greatest potential for improving the operation of the air transportation system. to accomplish this, NASA is building an Aviation System Analysis Capability (ASAC). The ASAC differs from previous NASA modeling efforts in that the economic behavior of buyers and sellers in the air transportation and aviation industries is central to its conception. to link the economics of flight with the technology of flight, ASAC requires a parametrically based mode with extensions that link airline operations and investments in aircraft with aircraft characteristics. This model also must provide a mechanism for incorporating air travel demand and profitability factors into the airlines' investment decisions. Finally, the model must be flexible and capable of being incorporated into a wide-ranging suite of economic and technical models that are envisioned for ASAC. We describe a second-generation Air Carrier Investment Model that meets these requirements. The enhanced model incorporates econometric results from the supply and demand curves faced by U.S.-scheduled passenger air carriers. It uses detailed information about their fleets in 1995 to make predictions about future aircraft purchases. It enables analysts with the ability to project revenue passenger-miles flown, airline industry employment, airline operating profit margins, numbers and types of aircraft in the fleet, and changes in aircraft manufacturing employment under various user-defined scenarios.

Author

Systems Analysis; Econometrics; Demand (Economics); Improvement; Transportation

19970018626 Advisory Group for Aerospace Research and Development, Flight Vehicle Integration Panel, Neuilly-Sur-Seine, France

Subsystem Integration for Tactical Missiles (SITM) and Design and Operation of Unmanned Air Vehicles (DOUAV) ***L'Integration des Sous-Systemes dans les Missiles Tactiques et la Conception et l'Exploitation des Vehicules sans Pilote***

Nov. 1996; 356p; In English; In French, 9-12 Oct. 1995, Ankara, Turkey; Sponsored by Advisory Group for Aerospace Research and Development, France; Also announced as 19970018627 through 19970018652

Report No.(s): AGARD-CP-591; ISBN-92-836-0033-9; Copyright Waived; Avail: CASI; A16, Hardcopy; A03, Microfiche

Papers address examples of integrating advanced sensors, guidance control systems, and navigation systems. Methods for testing missiles, including lessons learned from Norway's testing of the Penguin Mk2, are discussed. Design issues, payloads and their associated technologies, and operational issues are examined in relation to Unmanned Air Vehicles (UAV). Specific systems described included: the French Self Contained Early Warning System against anti-ship missiles; the Phoenix; Boeing's heliwing; the Crecelle; and the US Navy's Tilt Rotor UAV demonstrator.

Author

Systems Integration; Missiles; Helicopters; Flight Tests; Integral Rocket Ramjets; Missile Configurations; Aerodynamic Coefficients; Missile Control; Pilotless Aircraft; Conferences

02
AERODYNAMICS

Includes aerodynamics of bodies, combinations, wings, rotors, and control surfaces; and internal flow in ducts and turbomachinery.

19970017953 Old Dominion Univ., Dept. of Aerospace Engineering, Norfolk, VA USA

Initialization and Simulation of Three-Dimensional Aircraft Wake Vortices ***Final Report, period ending May 1997***

Ash, Robert L., Old Dominion Univ., USA; Zheng, Z. C., Old Dominion Univ., USA; May 1997; 14p; In English

Contract(s)/Grant(s): NAG1-1437

Report No.(s): NASA-CR-204437; NAS 1.26:204437; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This paper studies the effects of axial velocity profiles on vortex decay, in order to properly initialize and simulate three-dimensional wake vortex flow. Analytical relationships are obtained based on a single vortex model and computational simulations

are performed for a rather practical vortex wake, which show that the single vortex analytical relations can still be applicable at certain streamwise sections of three-dimensional wake vortices.
Author
Three Dimensional Flow; Aircraft Wakes; Vortices; Computerized Simulation

19970018069 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
An Investigation into the Effects of Lateral Aerodynamic Asymmetries, Lateral Weight Asymmetries, and Differential Stabilator Bias on the F-15 Directional Flight Characteristics at High Angles of Attack
Evans, David R., Air Force Inst. of Tech., USA; Mar. 1996; 96p; In English
Report No.(s): AD-A319164; AFOIT/GAE/ENY/96M-1; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

The F-15 is a stable aircraft throughout most of its flight envelope. However, it still exhibits an uncommanded yawing and rolling tendency at high angles-of-attack. Identified influencing factors of this uncommanded motion are lateral aerodynamic asymmetries, lateral weight asymmetries, and differential stabilator bias. Previous research into the effects of these influencing factors has been qualitative. This thesis quantifies the effects and then identifies a symmetric F-15 configuration. The quantifying metric presented is net yaw acceleration. This thesis used both computer simulation and experimental flight test to quantify these effects. A discussion of each influencing factors effects on the F-15B high AOA net yaw acceleration is presented. Aerodynamic asymmetries of the baseline F-15B are shown to cause a right yaw. Lateral weight asymmetries are shown to cause yaw acceleration away from the weight asymmetry. And, small changes in differential stabilator bias are shown to have little influence on net yaw acceleration. Considering these discussions, the baseline F-15B is identified as the symmetric F-15B. Finally, this thesis identifies two possible causes for F-15 departures, transient net yaw acceleration and combined sense of yaw and roll rate. The understandings of these possible causes on F-15 departures are just beginning to be evaluated.
DTIC
F-15 Aircraft; Yaw; Roll; Aerodynamic Characteristics; Flight Tests; Flight Simulation

19970018077 Naval Surface Warfare Center, Dahlgren, VA USA
Nonlinear Structural Load Distribution Methodology for the Aeroprediction Code
McInville, Roy M., Naval Surface Warfare Center, USA; Moore, Frank G., Naval Surface Warfare Center, USA; Housh, Clint, Naval Surface Warfare Center, USA; Sep. 1996; 80p; In English
Report No.(s): AD-A318543; NSWCDD/TR-96/133; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

New methodology has been added to the NSWCDD Aeroprediction code to permit the distribution of the local linear and nonlinear aerodynamic loads along the body length and over the wing and tail lifting surfaces. The new techniques extend to both the PHI = 0 deg and PHI = 45 deg roll positions and to both windward and leeward lifting surfaces in the 45 deg orientation. The local loads are integrated to get the distribution of the shear and bending moments for use in structural analysis and design. Navier-Stokes CFD computations for the Seasparrow missile were used in the development of these extensions to the code and in validating their effectiveness. In general, good agreement with the CFD results is obtained.
DTIC
Aerodynamic Loads; Load Distribution (Forces); Tail Surfaces; Wings; Navier-Stokes Equation; Computational Fluid Dynamics

19970018118 Minnesota Univ., Dept. of Aerospace Engineering and Mechanics, Minneapolis, MN USA
Aerodynamic Dissemination ***Final Report, 15 Jul. 1994 - 14 Jul 1996***
Joseph, Daniel D., Minnesota Univ., USA; Beavers, Gordon S., Minnesota Univ., USA; Sep. 30, 1996; 14p; In English
Contract(s)/Grant(s): DAAH04-94-G-0266
Report No.(s): AD-A316543; ARO-33130.1-MA; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

We have built a shock tube and liquid injection system for studying the aerodynamic breakup of thickened TEP and other viscoelastic liquids under conditions that simulate high altitude, high Mach number intercept conditions.
DTIC
Aerodynamic Interference; Liquids; Viscoelasticity

19970018159 NASA Lewis Research Center, Cleveland, OH USA
A Study of Large Droplet Ice Accretion in the NASA Lewis IRT at Near-Freezing Conditions, Part 2
Addy, Harold E., Jr., NASA Lewis Research Center, USA; Miller, Dean R., NASA Lewis Research Center, USA; Ide, Robert F., Army Research Lab., USA; Apr. 1997; 14p; In English; Aircraft Inflight Icing, 6-8 May 1996, Springfield, VA, USA; Sponsored by Federal Aviation Administration, USA
Contract(s)/Grant(s): RTOP 505-68-10

Report No.(s): NASA-TM-107424; NAS 1.15:107424; E-10668; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Results of experiments designed to determine the effects of large droplet ice accretion on a NACA 23012 wing section are presented. Using primarily an icing condition with a median volumetric diameter droplet size of 160 micron and a liquid water content of 0.82 grams per cubic meter, the effects of various air temperatures, angles of attack, and de-icer boot cycle interval times on ice accretion were studied. Measurements of aerodynamic performance penalties due to the ice accretions were made. Results were also compared with similar tests conducted with a Twin Otter wing section in Part 1 of this study. The form of the ice from the large droplet cloud varied as a function of air total temperature; particularly at the near-freezing temperatures of 28 F to 34 F. Changing boot cycle interval time did not prevent formation of an ice ridge. The most detrimental aerodynamic effects occurred at an air total temperature of 28 F.

Author

Ice Formation; Wings; Angle of Attack; Atmospheric Temperature; Aerodynamic Characteristics; Wind Tunnel Tests; Aircraft Icing

19970018310 Office National d'Etudes et de Recherches Aerospatiales, Paris, France

Modeling of Airfoil-Vortex Interaction and Application to a Helicopter Rotor. Contribution to Blade-Vortex Interaction Noise Prediction ***Modelisation de l'interaction profil-tourbillon et application au rotor helicoptere. Contribution 'a la prevision du bruit d'interaction pale-tourbillon***

Rahier, Gilles, Paris VI Univ., France; 1997; ISSN 0078-3781; 218p; In French; Original contains color illustrations

Report No.(s): ONERA-NT-1997-9; No Copyright; Avail: CASI; A10, Hardcopy; A03, Microfiche

This thesis contributes to the study of the Blade-Vortex Interaction (BVI) noise of helicopter main rotors. It addresses the prediction of blade pressure fluctuations which are the main BVI noise sources. The first part deals with the study of 2-dimensional BVI in an inviscid incompressible fluid. The calculations are performed using an integral method and take into account the deformation of the vortices in case of close interactions. Several vortex models are studied and their influence on the calculated airfoil response is analysed. Predictions are compared to other theoretical results and to experiment. The prediction method is then used to put to light the influence of strong interaction main parameters. In the second part of the study, the calculation method is applied to a helicopter rotor through transposition of the 3D real problem in a multi 2D problem. Vortex locations and circulations are provided by a modelling of blade wake roll up. A prediction law for the evolution of vortex core radii is proposed. Finite span and compressibility effects are introduced by way of corrections. This approach is validated through comparisons with experiment for a rotor interacting with a prescribed vortex and for a rotor interacting with its self generated vortices. As a conclusion, a synthesis of the capabilities and limitations of the method is presented and perspectives are drawn.

Author

Mathematical Models; Airfoils; Blade-Vortex Interaction; Rotary Wings; Noise Prediction

19970018356 Minnesota Univ., Dept. of Mechanical Engineering, Minneapolis, MN USA

An Experimental/Modeling Study of Jet Attachment during Counterflow Thrust Vectoring ***Final Report, 1 Jul. 1995 - 30 Jun. 1996***

Strykowski, Paul J., Minnesota Univ., USA; Jun. 1997; 168p; In English

Contract(s)/Grant(s): NAG1-1736

Report No.(s): NASA-CR-204436; NAS 1.26:204436; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Recent studies have shown the applicability of vectoring rectangular jets using asymmetrically applied counterflow in the presence of a short collar. This novel concept has applications in the aerospace industry where counterflow can be used to vector the thrust of a jet's exhaust, shortening take-off and landing distances and enhancing in-flight maneuverability of the aircraft. Counterflow thrust vectoring, 'CFTV' is desirable due to its fast time response, low thrust loss, and absence of moving parts. However, implementation of a CFTV system is only possible if bistable jet attachment can be prevented. This can be achieved by properly designing the geometry of the collar. An analytical model is developed herein to predict the conditions under which a two-dimensional jet will attach to an offset curved wall. Results from this model are then compared with experiment; for various jet exit Mach numbers, collar offset distances, and radii of curvature. Their excellent correlation permits use of the model as a tool for designing a CFTV system.

Author

Thrust Vector Control; Counterflow; Mathematical Models; Aircraft Engines; Jet Flow

19970018486 Army Research Lab., Vehicle Technology Center, Hampton, VA USA

Performance and Vibratory Loads Data From a Wind-Tunnel Test of a Model Helicopter Main-Rotor Blade With a Paddle-Type Tip

Yeager, William T., Jr., Army Research Lab., USA; Noonan, Kevin W., Army Aviation Systems Command, USA; Singleton, Jeffrey D., Army Research Lab., USA; Wilbur, Matthew L., Army Research Lab., USA; Mirick, Paul H., Army Research Lab., USA; May 1997; 30p; In English

Contract(s)/Grant(s): RTOP 505-63-36-02

Report No.(s): NASA-TM-4754; L-17558; NAS 1.15:4754; ARL-TR-1283; ATCOM-TR-97-A-006; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

An investigation was conducted in the Langley Transonic Dynamics Tunnel to obtain data to permit evaluation of paddle-type tip technology for possible use in future U.S. advanced rotor designs. Data was obtained for both a baseline main-rotor blade and a main-rotor blade with a paddle-type tip. The baseline and paddle-type tip blades were compared with regard to rotor performance, oscillatory pitch-link loads, and 4-per-rev vertical fixed-system loads. Data was obtained in hover and forward flight over a nominal range of advance ratios from 0.15 to 0.425. Results indicate that the paddle-type tip offers no performance improvements in either hover or forward flight. Pitch-link oscillatory loads for the paddle-type tip are higher than for the baseline blade, whereas 4-per-rev vertical fixed-system loads are generally lower.

Author

Rotary Wings; Performance Tests; Vibratory Loads; Transonic Wind Tunnels; Wind Tunnel Tests; Paddles

19970018630 Wright Lab., Weapon Flight Mechanics Div., Eglin AFB, FL USA

Analysis of Wrap-Around Fin and Alternative Deployable Fin Systems for Missiles

Abate, Gregg L., Wright Lab., USA; Winchenbach, Gerald, Wright Lab., USA; Nov. 1996; 12p; In English; Also announced as 19970018626; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

This paper will present aerodynamic results of investigations of wrap around fin missile configurations. The investigations were carried out at Wright Laboratory's Armament Directorate, Eglin AFB, FL. The investigations have shown that instabilities exist in the form of an undamped side moment induced by the pitching motion of the missile, a roll moment at zero degrees angle-of-attack, and a roll moment reversal through Mach 1. This paper will also present data for alternative deployable fin designs.

Author

Missile Configurations; Fins; Wrap; Aerodynamic Coefficients; Computational Fluid Dynamics

19970018632 MATRA Defense Espace, Velizy-Villacoublay, France

Practical Use of Flight Tests Results for Estimations of Aerodynamic Coefficients *Determination de Coefficients Aerodynamiques avec des Resultats d'Essais en Vol*

Schmitt, G., MATRA Defense Espace, France; Nov. 1996; 15p; In French; Also announced as 19970018626; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

At the end of a missile development, flight tests have to validate the overall missile performances. The flight tests are particularly used for the validation of the aerodynamic characteristics. After that, some improvements of the aerodynamic modeling or even adjustments of the aerodynamic design can be initiated. Simulations allow to limit expensive flight tests to a minimal number needed to perfect the guidance and control functions embedded in the missile. The aerodynamic coefficients are not directly measured in flight, but computed from measured flight data. Some results obtained with a long range cruise missile are therefore presented. The comparison with wind tunnel test data are explained and are satisfactory.

Author

Cruise Missiles; Aerodynamic Coefficients

19970018635 Roketsan A.S. Ankara, Turkey

Monte Carlo Simulation Studies of Unguided and Guided Missiles Based on Probabilistic Modelling of Aerodynamic Coefficients

Merttopcuoglu, A. Osman, Roketsan A.S. Ankara, Turkey; Ozdamar, Hudai H., Roketsan A.S. Ankara, Turkey; Ozgoren, M. Kemal, Middle East Technical Univ., Turkey; Nov. 1996; 8p; In English; Also announced as 19970018626

Contract(s)/Grant(s): AGARD Proj. T77; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The main motivation underlying this work is to develop a methodology by which the effect of aerodynamic estimation errors on flight simulation problems are investigated. A 'family' is defined as a predetermined class of similar missile configurations for which a reference aerodynamic data is available. The error is defined as the difference between the results of the 'available computational method' and the reference data. Then the statistical characteristics of the errors in the aerodynamic coefficients

are determined assuming Gaussian probability distribution for the members of the 'family'. For a proposed missile configuration which fits to the 'family', the aerodynamic coefficients are first obtained using the 'available computational method'. Afterwards, the errors in these aerodynamic coefficients are estimated using the statistical characteristics determined above.
Derived from text
Monte Carlo Method; Guidance (Motion); Aerodynamic Coefficients; Flight Simulation

19970018638 Technical Univ. of Lisbon, Mechanical Engineering Dept., Portugal
Aerodynamics of the ARMOR X7 UAV
deBrederode, V., Technical Univ. of Lisbon, Portugal; Jorge, P. A., Technical Univ. of Lisbon, Portugal; Marcelino, J. R., Technical Univ. of Lisbon, Portugal; Patraquim, R., Technical Univ. of Lisbon, Portugal; Nov. 1996; 11p; In English; Also announced as 19970018626; Sponsored in part by PEDIP; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The paper reports the most significant aspects of the aerodynamic design and testing of a low speed UAV which is being developed in Portugal as a joint University/Industry project. Starting from a baseline configuration of the air-vehicle aimed at complying with mission requirements in terms of endurance and range, a parametric sensitivity study is carried out for defining the optimum lay-out of the liftinG surfaces. The family of the wing aerofoils is selected from the Wortmann series and a new aerofoil is designed for the tip section. Predicted and wind-tunnel results for the fuselage and inner-wing panels are reported and discussed and an assessment of the aerodynamic behaviour of the whole configuration is made.
Derived from text
Aerodynamic Characteristics; Design Analysis; Flight Tests; Airfoils; Armor; Pilotless Aircraft

03
AIR TRANSPORTATION AND SAFETY

Includes passenger and cargo air transport operations; and aircraft accidents.

19970018364 Systems Resource Management, Inc., Kensington, MD USA
Proceedings of the FAA International Conference on Aircraft Inflight Icing, Volume 2, Working Group Papers *Final Report*
Aug. 1996; 625p; In English, USA
Report No.(s): AD-A316441; DOT/FAA/AR-96/81-VOL-2; No Copyright; Avail: CASI; A99, Hardcopy; A06, Microfiche

The conference included a review of major aspects of airworthiness when operating in icing conditions. It consisted of an opening plenary session, five working group sessions addressing (1) Icing Environmental Characterization, (2) Ice Protection and Ice Detection, (3) Forecasting and Avoidance, (4) Requirements for and Means of Compliance in Icing Conditions (Including Icing Simulation Methods), (5) Operational Regulations and Training Requirements, and a closing plenary session. One of the primary areas of concern at the conference was icing due to supercooled large droplets (SLD). Volume I of the conference proceedings covers presentations of the speakers at the opening plenary session and the reports of the co-chairs of the working groups at the closing plenary session. Volume 2 of the conference proceedings is a compendium of technical papers presented in the various working groups.
DTIC
Aircraft Icing; Deicing; Drop Size; Ice Formation; Ice Prevention

19970018514 Massachusetts Inst. of Tech., Cambridge, MA USA
A Probability-Base Alerting Logic for Aircraft on Parallel Approach
Carpenter, Brenda D., Massachusetts Inst. of Tech., USA; Kuchar, James K., Massachusetts Inst. of Tech., USA; Apr. 1997; 110p; In English
Contract(s)/Grant(s): RTOP 538-04-11-17; NASA Order L-44581-D
Report No.(s): NASA-CR-201685; NAS 1.26:201685; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

This document discusses the development and evaluation of an airborne collision alerting logic for aircraft on closely-spaced approaches to parallel runways. A novel methodology is used when links alerts to collision probabilities: alerting thresholds are set such that when the probability of a collision exceeds an acceptable hazard level an alert is issued. The logic was designed to limit the hazard level to that estimated for the Precision Runway Monitoring system: one accident in every one thousand blunders which trigger alerts. When the aircraft were constrained to be coaltitude, evaluations of a two-dimensional version of the alerting logic show that the achieved hazard level is approximately one accident in every 250 blunders. Problematic scenarios have been identified and corrections to the logic can be made. The evaluations also show that over eighty percent of all unnecessary alerts

were issued during scenarios in which the miss distance would have been less than 1000 ft, indicating that the alerts may have been justified. Also, no unnecessary alerts were generated during normal approaches.
Author
Approach; Runways; Pilot Performance; Aircraft Safety

19970018578 Federal Aviation Administration, Airport and Aircraft Safety, Atlantic City, NJ USA
Halon Replacement Options for Use in Aircraft Fire Suppression Systems ***Final Report***
Tapscott, Robert, Federal Aviation Administration, USA; Sep. 1996; 65p; In English
Report No.(s): AD-A318108; DOT/FAA/AR-96/90; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

This report contains a summary of available fire suppression agents, their properties, and applicability in the various aircraft applications. Classes of agents, with presently available agents listed, are recommended for use in the development of test protocols. The test protocol developed for a class of agents can be used, with minor modifications, to test all agents belonging to that class.
DTIC
Fire Extinguishers; Aircraft; Fires; Halogen Compounds; Fire Prevention; Fire Control; Environment Effects

19970018580 Civil Aeromedical Inst., Oklahoma City, OK USA
Flight Inspection Crew Resource Management Training Needs Analysis ***Final Report***
Bailey, Lawrence L., Civil Aeromedical Inst., USA; Shaw, Rogers V., Civil Aeromedical Inst., USA; Sep. 1996; 17p; In English
Report No.(s): AD-A318104; DOT/FAA/AM-96/24; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

On October 26, 1993, there was a fatal crash of a Federal Aviation Administration (FAA) flight inspection aircraft. During the accident investigation, the National Transportation Safety Board (NTSB) cited ineffective crew resource management (CRM) as one of the causal factors and recommended CRM training for flight inspection aircrews. As part of the FAA's response to the NTSB recommendation, a CRM training needs analysis was conducted. Cluster analytic results of the identified training needs suggested three categories affecting crew performance: (1) technical skills, (2) crew coordination skills, and (3) the organization context in which flight inspection crews perform. Implications for CRM awareness training are discussed. The purpose of this report is to document the flight inspection CRM training needs that emerged from the analyses and to recommend steps for developing a flight inspection CRM training program.
DTIC
Flight Crews; Flight Training; Human Performance; Aircraft Accident Investigation; Aircraft Accidents

19970018619 Colorado State Univ., Dept. of Atmospheric Science, Fort Collins, CO USA
Identification of Potential Aircraft Icing Regions Through Multispectral Analysis of GOES-8 Imagery
Schrumpf, Bradford D., Colorado State Univ., USA; Jan. 1997; 169p; In English
Report No.(s): AD-A320083; AFIT-96-136; No Copyright; Avail: CASI; A08, Hardcopy; A02, Microfiche

Aviation weather forecasters are still greatly challenged to forecast aviation weather hazards for large areas of atmosphere with few in-situ observations and little detailed information from which to work. Forecasters generally lack sufficient guidance to assist them in the prediction of icing occurrences or intensity. In-flight aircraft icing remains a significant aviation hazard. Icing intensity is related to the rate of accretion as well as the aircraft type and the icing's effects on aircraft flight performance. Icing regions currently can only be identified from subjective reports made by aircraft pilots (PIREPs). The severity of aircraft icing is found to be quite sensitive to temperature, liquid water content, and droplet size distribution along the flight path within the icing cloud. The difficulty of their direct measurement and the variability of these factors with altitude, position, and time, coupled with variable aircraft sensitivities, make forecasting and identifying icing environments quite difficult With the advent of the next generation of Geostationary Operational Environmental Satellites (GOES), additional spectral channels with improved ground resolution are available for use in a wide variety of research applications. One important outcome of applied research based on improved GOES-8 imager products is analysis technique developments that will lead to better forecasts of hazardous aircraft flying conditions.
DTIC
Weather Forecasting; Probability Theory; Predictions; Moisture Content; Ice Formation; GOES 8; Flight Characteristics

04
AIRCRAFT COMMUNICATIONS AND NAVIGATION

Includes digital and voice communication with aircraft; air navigation systems (satellite and ground based); and air traffic control.

19970018027 Air Force Inst. of Tech., Wright-Patterson AFB, OH USA
Analysis of Multimode Low-Probability-of-Intercept (LPI) Communications With Atmospheric Effects
Ghordlo, Ala, Air Force Inst. of Tech., USA; Dec. 1996; 131p; In English
Report No.(s): AD-A319680; AFIT/GE/ENG/96D-03; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche

This research expanded Low Probability of Intercept (LPI) communications analysis in two areas. First, multimode communication was included to account for ground to ground and air to ground links in addition to the standard air to air links traditionally used in LPI analysis. The propagation equations for the three modes of interest were derived and included in LPI analytic models in the form of a mode quality factor to account for multimode LPI scenarios. This new quality factor was used in studying several communication and interception link combinations. Variations due to differences between the communication and interception modes were presented graphically. Second, atmospheric conditions were included to account for atmospheric attenuation. Previously, both links were assumed to be under the same atmospheric conditions. This assumption limits LPI analysis to scenarios where the receiver and interceptor are located close to each other. Therefore, the atmospheric quality factor had to be expanded to include scenarios where the communication link and the interception link are experiencing different and possibly fluctuating atmospheric conditions. The atmospheric propagation losses were accounted for by using the Liebe atmospheric propagation model to estimate atmospheric attenuation in dB/km for any practical atmospheric conditions. The atmospheric quality factor was then applied to the analysis of various scenarios for communication and interception links under similar and different atmospheric conditions. The results were represented graphically emphasizing the changes in LPI quality due to atmospheric conditions. It was apparent from the simulations, that LPI analysis was greatly enhanced by including the atmospheric quality factor. Finally, using both the mode and the atmospheric quality factors along with all the standard quality factors, a comprehensive L
DTIC
Communication Networks; Atmospheric Attenuation; Atmospheric Effects

19970018085 Wright Lab., Avionics Directorate, Wright-Patterson AFB, OH USA
Achieving Near-Optimal Sensor Allocation Policies Through Reinforcement Learning ***Final Report***
Malhotra, P., Wright Lab., USA; Oct. 1996; 11p; In English
Contract(s)/Grant(s): AF Proj. 2304
Report No.(s): AD-A318335; WL-TM-96-1134; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Tactical aircraft must frequently perform complex sequential tasks in which they rely heavily on the integration of sensory data to assess state and maintain situational awareness. in modern systems, the control of the sensors' information-gathering activities is critical-optimal performance is desired. but this is made difficult by the requirements to contend with sophisticated flexible sensory assets, and volatile, uncertain environments. this paper introduces the sensor management problem and the plausibility of leveraging a machine learning algorithm toward this difficult challenge.
DTIC
Machine Learning; Policies; Radar Tracking; System Identification; Multisensor Fusion

19970018633 Norwegian Defence Research Establishment, Div. for Electronics, Kjeller, Norway
A Navigation System Concept for a Modern Anti-Ship Missile
Hoelsaeter, O., Norwegian Defence Research Establishment, Norway; Jalving, B., Norwegian Defence Research Establishment, Norway; Nov. 1996; 12p; In English; Also announced as 19970018626; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A navigation system concept for a modern anti-ship missile has been investigated. The navigation system can be divided into several subsystems. At open sea, altitude measurements are used in a Kalman filter to limit the inertial navigation system (INS) error propagation. Correspondingly, terrain contour matching (TERCOM) position updates are used when flying over land. A method for estimating the sea state and predicting extreme wave heights, which is useful in choosing sea skimming altitude, is also discussed. Finally, a model based compensator, which reduces dynamic errors of the INS attitude references used for for seeker stabilization, is described. The paper presents the theory of the various subsystems and how they are integrated. Results from tests with real data as well as simulations are presented.
Author
Air to Surface Missiles; Inertial Navigation; Kalman Filters; Sea States; Computerized Simulation

05
AIRCRAFT DESIGN, TESTING AND PERFORMANCE

Includes aircraft simulation technology.

19970018107 RAND Corp., Santa Monica, CA USA
Application of F-l17 Acquisition Strategy to Other Programs in the New Acquisition Environment
Smith, Giles K., RAND Corp., USA; Shulman, Hyman L., RAND Corp., USA; Leonard, Robert S., RAND Corp., USA; Jan. 1996; 75p; In English; Limited Reproducibility: More than 20% of this document may be affected by microfiche quality
Contract(s)/Grant(s): F49642-96-C-0001
Report No.(s): AD-A317934; ISBN-0-8330-2404-3; No Copyright; Avail: Issuing Activity (Defense Technical Information Center (DTIC)), Microfiche

It is frequently argued that Special Access Programs (SAPs) are more effectively and efficiently managed than their counterparts conducted in a more open environment. Unfortunately, such programs usually remain under tight security control, making it impossible to rigorously test the accuracy of the claims or to systematically identify and apply strategies and attributes to a wider variety of acquisition programs.
DTIC
F-17 Aircraft; Acquisition; Strategy; Fighter Aircraft; Utilization; Project Management

19970018125 Army Aviation Technical Test Center, Fort Rucker, AL USA
Methodology Investigation, Global Positioning System (GPS) Vehicle Tracking System for Flight Testing of Fixed- and Rotary-Wing Aircraft, *Jun. 1995 - Apr. 1996*
Martin, Larry, Army Aviation Technical Test Center, USA; Jun. 1996; 75p; In English
Contract(s)/Grant(s): TECOM Proj. 7-CO-M95-AVD-004
Report No.(s): AD-A315263; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The U.S. Army Aviation Technical Test Center (ATTC) conducted the methodology investigation of the global positioning system (GPS) vehicle tracking system at White Sands Missile Range from June 1995-April 1996. The objectives were to quantify the accuracy of the GPS tracking system throughout the dynamics of normal helicopter flight and ensure that the rotor effect on the GPS signal reception is considered. It was concluded that the system as tested is capable of tracking helicopters through their flight envelope to an accuracy of less than 2 feet spherical error probable in real time, and the rotor system appeared to have little effect on the GPS signals.
DTIC
Global Positioning System; Rotary Wing Aircraft; Real Time Operation; Tracking (Position); Flight Envelopes

19970018377 Defence Science and Technology Organisation, Air Operations Div., Melbourne, Australia
Australian Airborne Trials of the Sikorsky S-70B-2 Helicopter, Part 1, Performance Measurements
Arney, A. M., Defence Science and Technology Organisation, Australia; Fieldhouse, I., Defence Science and Technology Organisation, Australia; Jan. 1997; 72p; In English
Report No.(s): DSTO-TR-0463; AR-009-955; Copyright; Avail: Issuing Activity (Aeronautical and Maritime Research Lab., PO Box 4331, Melbourne Vic 3001, Australia), Hardcopy, Microfiche

Flight tests of Sikorsky S-70B-2 helicopter were conducted to assess limits for this helicopter when flown from an 'Adelaide' frigate. The baseline data, which will be used in development of a mathematical model of the helicopter, is established. Performance tests and data processing procedures are described.
Derived from text
Helicopters; Sikorsky Aircraft; Flight Tests; Data Processing; Computer Programs; Aircraft Performance; Performance Tests

19970018493 Washington Univ., Dept. of Mechanical Engineering, Seattle, WA USA
Axial Crack Propagation and Arrest in a Pressurized Fuselage *Final Report*
Kosai, M., Washington Univ., USA; Shimamoto, A., Washington Univ., USA; Kobayashi, A. S., Washington Univ., USA; Sep. 1996; 187p; In English
Report No.(s): AD-A318094; UW/DME/TR-95/2; DOT/FAA/AR-95/43; No Copyright; Avail: CASI; A09, Hardcopy; A02, Microfiche

A hybrid experimental-numerical investigation was undertaken to establish a practical crack kinking criterion in the presence or absence of multiple site damage (MSD) in a pressurized airplane fuselage. Ramulu Kobayashi crack kinking criteria was modified to predict self-similar crack propagation along a line of MSD and subsequent kinking near a tear strap. Instrumented biaxial

test specimens and small-scale fuselage rupture experiments were conducted to generate the crack kinking and crack velocity data which was then input to a large deformation, elasto-dynamic, finite element model of the fracture specimen. The computed Mixed-Modes I and II stress intensity factors and a large axial stress preceding the propagating crack were used to evaluate the self-similar crack extension and the crack kinking criterion along the crack trajectory. Excellent agreement was obtained between the predicted and measured crack kinking angles and locations. Additional verification was made through the match between the computed and measured strain gage data. The biaxial specimen tests showed that in spite of the presence of plane strain Mode-2 stress intensity factor (K11) and the large axial stress ahead of the propagating crack, axial crack extension would continue in the axial direction of the skin is weakened by MSD. The crack propagated through the tear strap in the presence of a continuous MSD and kinked when the MSD terminated at the tear strap. However, if there is a short secondary crack under the tear strap, the lead crack kinked at the long groove end but reconnected to the secondary crack. The small-scale fuselage rupture tests showed that the pre-existing axial through crack along the stringer immediately kinked upon propagation due to the Mixed-Modes 1 and 2 state caused by the one-sided opening of the crack flap.
DTIC
Finite Element Method; Crack Propagation; Axial Stress; Fuselages; Plane Strain; Fracturing; Deformation; Structural Analysis; Cracks

19970018505 Federal Aviation Administration, Technical Center, Atlantic City, NJ USA
Flight Test Investigation of Rotorcraft Wake Vortices in Forward Flight ***Final Report***
Teager, Stephen A., Federal Aviation Administration, USA; Biehl, Keith J., Federal Aviation Administration, USA; Garodz, Leo J., Scientific and Engineering Solutions, Inc., USA; Tymczyszym, Joseph J., Scientific and Engineering Solutions, Inc., USA; Burnham, David C., Scientific and Engineering Solutions, Inc., USA; Feb. 1996; 95p; In English
Report No.(s): AD-A318103; DOT/FAA/CT-94/117; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

This report presents the results of helicopter flight tests and wake vortex measurements which were designed to provide data necessary for the assessment of hazards to following aircraft. The tests described in this report were conducted using small probe airplanes and a Laser Doppler Velocimeter for wake vortex measurements during forward-flight helicopter operations. Four helicopters, having weights ranging from 7,600 to 70,000 pounds, were used in the tests as the wake vortex generating aircraft. Wake vortex strength and decay characteristics as determined from the flight test results are discussed. In the absence of encounter measurements for the case of hover flight, it is recommended that small airplanes, at the same altitude and downwind of a hovering helicopter, maintain at least 500 feet of separation.
DTIC
Flight Tests; Helicopter Wakes; Rotary Wing Aircraft; Vortices; Flight Hazards; Aircraft Safety

19970018627 NFT, Kongsberg, Norway
Penguin MK2 MOD7 Integration in the Sikorsky S-70B Helicopter Integration and Live Fire Testing
Sollie, Are Christian, NFT, Norway; Spitz, Steve, Sikorsky Aircraft, USA; Nov. 1996; 18p; In English; Also announced as 19970018626; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The paper describes the Penguin MK2 MOD7 (AGM-119B) anti-ship missile integration in the Sikorsky S-70B helicopter. Innovative design techniques allowed use of existing aircraft and missile hardware. Only software development was required to integrate the Penguin missile with the S-70B aircraft. The paper discusses briefly the system integration testing and presents some of the test results. The system integration testing was based on extensive simulation of mathematical models and a low-cost instrumentation of a captive carry flight test range in the Long Island Sound, USA. Finally, some test results from a live firing demonstration performed at USN NAWCAD, Patuxent River are given.
Author
Systems Integration; Sikorsky Aircraft; Helicopters; Air to Surface Missiles; Flight Tests; Captive Tests; Computer Programs

19970018631 Scientific and Technical Research Council of Turkey, Defense Industries Research and Development Inst., Ankara, Turkey
Linear Stability Analysis of Unguided Missiles with Wrap-Around Tail Fins in Free Flight
Tanrikulu, O., Scientific and Technical Research Council of Turkey, Turkey; Onen, C., Scientific and Technical Research Council of Turkey, Turkey; Mahmutyazicioglu, G., Scientific and Technical Research Council of Turkey, Turkey; Bektas, I., Scientific and Technical Research Council of Turkey, Turkey; Nov. 1996; 13p; In English; Also announced as 19970018626; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A large number of tube launched unguided missiles of NATO such as 70 mm Mk 66, 122 mm FIROS, 127 mm Mk 71, 160 mm RAYO and 227 mm MLRS have wrap-around tail fins (WAF). These missiles have more complicated flight mechanics when

compared to the ones with flat and straight tail fins. This is due to the fact that WAF lack mirror symmetry. Detailed free flight mechanics analysis of such missiles were performed with particular emphasis given to the effect of out-of-plane static moment stability derivative C(sub m beta) on dynamic stability. In this study, combined effects of C(sub m beta) and Magnus moment stability derivative C(sub m beta(sub p)) on dynamic stability are explored. Aerodynamics and flight mechanics of a simple configuration with WAF are examined as a case study.
Author
Missile Configurations; Free Flight; Stability Derivatives; Dynamic Stability; Magnus Effect; Numerical Analysis

19970018640 Georgia Tech Research Inst., Atlanta, GA USA
Enabling Technology for UAVs
Michelson, Robert C., Georgia Tech Research Inst., USA; Nov. 1996; 10p; In English; Also announced as 19970018626; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Requirements for the performance of certain NATO missions in the 2015 - 2020 time frame have been examined. In addition, various unmanned aerial vehicle-borne sensor payloads have been identified which support the execution of these missions in an effective manner. Present state-of-the-art sensors and air vehicle systems do not provide the performance necessary to prosecute these missions in light of the anticipated future civil and military environment. This paper presents a discussion of the under-girding technologies which will make the predicted Unmanned Aerial Vehicle (UAV) performance possible. The description of these enabling technologies includes discussions concerning the present state of the art, their general applicability to a variety of UAV payloads, and the collateral technologies which will in turn facilitate the development of the chosen primary enabling technologies. Though a number of enabling technologies have application to the various UAV missions, seven are recommended for near term investment.
Derived from text
Mission Planning; North Atlantic Treaty Organization (NATO); Payloads; Pilotless Aircraft; Remote Sensors

19970018642 Lockheed Martin Tactical Aircraft Systems, Fort Worth, TX USA
Unmanned Tactical Aircraft: A Lockheed Martin Perspective
Chaput, Armand J., Lockheed Martin Tactical Aircraft Systems, USA; Albin, Timothy S., Lockheed Martin Tactical Aircraft Systems, USA; Hosmer, Douglas M., Lockheed Martin Tactical Aircraft Systems, USA; Weigel, Stephen R., Lockheed Martin Tactical Aircraft Systems, USA; Nov. 1996; 18p; In English; Also announced as 19970018626; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The Unmanned Tactical Aircraft (UTA) is described according to the Lockheed Martin perspective. This perspective contains a wide range of concepts including: th Lockheed Martin definition of an UTA; benefits; phased program approach; ”reusables” vs. ”expendables”; missile or fighter?; and an overall advanced UTA concept.
Derived from text
Pilotless Aircraft; Weapons Delivery

19970018646 MATRA Defense Espace, Advanced Studies Div., Velizy-Villacoublay, France
The MARVEL Maritime UAV
Pelous, Jean-Francois, MATRA Defense Espace, France; Barlow, Jewel B., Maryland Univ., USA; Nov. 1996; 10p; In English; Also announced as 19970018626; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

In the first part, we review the essential requirements for a UAV system marine use. Then, we present some of the specific Freewing TilitBody MARVEL aerodynamic characteristics and a short description of the landing system equipment used during the ship deck approach.
Author
Landing Aids; Pilotless Aircraft

19970018647 Bombardier, Inc., Systemes de Defense Div., Montreal, Quebec Canada
Conception and Development of an Automatic Maritime System Using a Generic Vehicle of the VTOL Type ***Conception et Developpment d’un Systeme d’Appontage Maritime Automatique d’un Vehicule Generique de Type VTOL***
deFerrier, Bernard, Bombardier, Inc., Canada; Reboulet, Claude, Centre d’Etudes et de Recherches, France; Nov. 1996; 8p; In French; Also announced as 19970018626; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The evolution of an automated ship recovery system for a VTOL UAV is discussed. The generic UAV model is based on the Canadair CL227 VTOL UAV. Test results concentrating on system control and response are provided. A description of the data link software and hardware components is presented . The approach describing the location of the air vehicle is based on the de-

compostion of the state vector into observable and non-observable components. This approach is validated by simulation. The simulation model is based on a six degree-of-freedom representation of the air vehicle, the ship, the data link system and the environment. The data link/recovery system uses vehicle control and ship motion algorithms which close the loop between the air vehicle and ship. Finally, the flight profiles produced by simulation are also discussed.
Author
Ships; Vertical Takeoff Aircraft; Remotely Piloted Vehicles; Systems Engineering; Flight Safety; Computerized Simulation; Control Systems Design

19970018648 Turkish Aerospace Industries, Design and Development Dept., Ankara, Turkey
Turkish Unmanned Air Vehicle Developments
Kaynak, Unver, Turkish Aerospace Industries, Turkey; Nov. 1996; 10p; In English; Also announced as 19970018626; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

There is an increase in understanding of the benefits of using UAV's under certain scenarios. Acquisition of operational UAV's for the Turkish military, and lessons learned from recent conflicts in some troubled areas of the world, give impetus to gaining some domestic expertise on the design and operation of drones. Under contract by the Undersecretariat of Defense Industries TAI designed, developed and flight tested two line-of-sight UAV prototypes between 1990-1992. The intent was firstly to demonstrate TAI's design capabilities, and later, to further develop the vehicles into mission capable vehicles by the addition of certain operational functions and mission payloads. The project was successfully completed with the delivery of the vehicles that had limited capabilities. TAI was responsible for the design and development of the airframe, systems integration, and ground and flight tests. Commercially available avionics systems were used in the ground control station and in the aircraft. The project enhanced the in-house knowledge base pertaining to unmanned air vehicles quite significantly, and encouraged the start of further activities that included target drones. Under the contract with MOD, TAI is currently developing a new target drone, TAI-UKHU, for use with the air defense units. In this paper, basically, TAI's efforts will be summarized which cover the UAV-X 1 and the UKHU target drone.
Author
Remotely Piloted Vehicles; Drone Vehicles; Avionics; Airframes; Aircraft Design; Systems Engineering

07
AIRCRAFT PROPULSION AND POWER

Includes prime propulsion systems and systems components, e.g., gas turbine engines and compressors; and onboard auxiliary power plants for aircraft.

19970018352 Toronto Univ., Inst. for Aerospace Studies, North York, Ontario Canada
Inviscid On-Design Propulsive Characteristics of Hypersonic Shock-Induced Combustion Ramjets
Sislian, J. P., Toronto Univ., Canada; Dudebout, R., Toronto Univ., Canada; Oppitz, R., Toronto Univ., Canada; Feb. 1997; ISSN 0082-5255; 362p; In English
Report No.(s): UTIAS-Rept-352; No Copyright; Avail: CASI; A16, Hardcopy; A03, Microfiche

Past and current space transportation vehicles have been configured as rocket-powered, multistage systems, and, with the notable exception of the U.S. Space Shuttle, have been fully expendable. to decrease launch costs, it is widely accepted that fully reusable space launch systems must be developed. Although much research is proceeding to develop fully reusable, rocket-powered space transportation vehicles such as the highly publicized U.S. DC-X program, one possible avenue of progress is to augment the rocket-powered propulsion with airbreathing propulsion. The potential benefits of pursuing airbreathing propulsion can be readily observed by comparing the weight distribution of current aircraft and rocket transportation systems. The most glaring difference is that oxygen, which is not carried aboard an airbreathing vehicle, occupies nearly 2/3 of a rocket-powered vehicle's takeoff weight. Carrying such a large portion of oxygen to propel the vehicle reduces the payload weight fraction; hence rocket-propelled vehicles and associated systems must be large and heavy. Moreover, and perhaps of greater consequence, the empty weight fraction, which includes structure, propulsion, tankage, power, controls and instrumentation, is significantly diminished. Hence, since no 'margin for error' is allowed in the design, reducing empty weight decreases reliability, robustness and flexibility. These factors and others contribute to very costly (approximately $2000 - $5000 per pound for launches to low earth orbit) and infrequent space launches. In comparison, airbreathing vehicles, such as common airplanes, have all of these desirable attributes. Hence, the long-term goal is to develop a space-transportation system augmented by air-breathing propulsion which has airplane-like qualities: high reliability and cost-effectiveness. The flight envelope that the proposed aerospace vehicle would traverse is much broader than common airplanes, however. As the air-breathing propulsion vehicle climbs, the atmospheric density and pres-

sure decrease exponentially and the amount of atmospheric oxygen available for burning the fuel decreases in similar proportions until, finally, airbreathing propulsion is not longer sustainable and rocket propulsion must complete the ascent to orbit. The energy that a vehicle must have to be in low earth orbit is almost entirely kinetic energy. Kinetic energy varies as the square of velocity or Mach number, hence the work done on the orbital mass is much more at higher speeds. Consequently, if the 'switchover' point between airbreathing and rocket propulsion occurs at a low Mach number, most of the work is accomplished by rockets and the take-off mass percentage of oxygen will not decrease appreciably. Therefore, the air-breathing propulsion system must accelerate the vehicle to very high Mach numbers. Conventional turbojet propulsion systems decrease severely in efficiency in the higher supersonic ranges (above Mach 3), hence other forms of high speed air-breathing propulsion must be utilized.
Derived from text
Ramjet Engines; Launch Costs; Aerospace Vehicles; Air Breathing Engines; Combustion; Design Analysis

08
AIRCRAFT STABILITY AND CONTROL

Includes aircraft handling qualities; piloting; flight controls; and autopilots.

19970018621 Old Dominion Univ., Dept. of Aerospace Engineering, Norfolk, VA USA
Aeroelastic, CFD, and Dynamics Computation and Optimization for Buffet and Flutter Applications ***Final Report, 1 Dec. 1995 - 30 Nov. 1996***
Kandil, Osama A., Old Dominion Univ., USA; Jan. 1997; 5p; In English
Contract(s)/Grant(s): NAG1-648
Report No.(s): NASA-CR-203244; NAS 1.26:203244; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Accomplishments achieved during the reporting period are listed. These accomplishments included 6 papers published in various journals or presented at various conferences; 1 abstract submitted to a technical conference; production of 2 animated movies; and a proposal for use of the National Aerodynamic Simulation Facility at NASA Ames Research Center for further research. The published and presented papers and animated movies addressed the following topics: aeroelasticity, computational fluid dynamics, structural dynamics, wing and tail buffet, vortical flow interactions, and delta wings.
CASI
Computational Fluid Dynamics; Delta Wings; Aeroelasticity; Wing Tips; Vortices; Buffeting; Flutter

19970018628 Defence Research Establishment Valcartier, Courcellette, Quebec Canada
Improved Engagement Envelope of a Tactical Missile with an Integral Rocket/Ramjet Engine
Lauzon, M., Defence Research Establishment Valcartier, Canada; Subsystem Integration for Tactical Missiles (SITM) and Design and Operation of Unmanned Air Vehicles (DOUAV); Nov. 1996; 17p; In English; Also announced as 19970018626; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

A trade-off study on mission effectiveness identified definite benefits of the solid fuel integral-rocket-ramjet engine over the solid rocket motor for a medium-range air-to-air tactical missile. A six-degrees-of-freedom trajectory simulation model was first developed to assess the performance and operating envelope of the solid rocket motor and the ramjet engine for tactical air-to-air missile applications. The 6DOF simulation code includes a fully algebraic model for ramjet propulsion, a model for missile guidance based on the law of proportional navigation and a three-degrees-of-freedom target trajectory model. It can be used to evaluate missile kinematic performance and effectiveness against a maneuvering target. Results show that ramjet propulsion improves three important performance characteristics of a missile, namely, the time-of-flight (average velocity), maximum range and end-game maneuverability for longer range missions. The solid rocket motor, with its high thrust output and low burn time, gives the tactical missile a higher average velocity and hence a better maneuverability for shorter range engagements. A missile time-of-flight envelope with a non-maneuvering target at 10 km altitude shows that the IRR missile offers a time-of-flight advantage for launch ranges greater than 25-35 km and improves the missile maximum range capability by 40%. The IRR engine also extends the 3 g(sub n) maneuverability boundary by 50% in slant range.
Author
Integral Rocket Ramjets; Air to Air Missiles; Propulsion System Performance; Maneuverability; Computerized Simulation; Missile Ranges; System Effectiveness

19970018634 Aerospatiale Missiles, Chatillon, France
Control of a Supersonic Air to Ground Missile with Very Lightly Damped Bending Modes
Friang, J. P., Aerospatiale Missiles, France; Bonnet, J. P., Aerospatiale Missiles, France; Duc, G., Ecole Superieure d'Electricite,

France; Nov. 1996; 16p; In English; Also announced as 19970018626; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

In this paper, an autopilot is designed to control a missile with very lightly damped bending modes, using the loopshaping H(sub infinity) design procedure of McFarlane and Glover. Robustness in the face of large modelling uncertainties (including parameter and bending modes) is then investigated using real mu-analysis. The autopilot of the Bank to Turn (BTT) missile developed by AEROSPATIALE (French Aerospace Industrial National Company) is finally validated on a non linear simulator: this will show the performances and the robustness of our design.
Derived from text
Automatic Control; Air to Surface Missiles; Automatic Pilots

09
RESEARCH AND SUPPORT FACILITIES (AIR)

Includes airports, hangars and runways; aircraft repair and overhaul facilities; wind tunnels; shock tubes; and aircraft engine test stands.

19970018140 Calspan Corp., Advanced Technology Center, Buffalo, NY USA
Advanced Turbine Aerothermal Research Rig (ATARR) Data Acquisition System Overview and Operator's Guide ***Final Report***
Haldman, C., Calspan Corp., USA; B. Meyer, Calspan Corp., USA; Dunn, M., Calspan Corp., USA; Moselle, J., Calspan Corp., USA; Sep. 1995; 194p; In English
Contract(s)/Grant(s): F 33615-88-C-2825; AF Proj. 3066
Report No.(s): AD-A315427; WL-TR-96-2015; No Copyright; Avail: CASI; A09, Hardcopy; A03, Microfiche

This document is one of a series prepared by Calspan Corporation for WPAFB WL/POTC that describes the construction and operation of the ATARR facility. This document addresses the issues surrounding the design and operation of the Data Acquisition System (DAS). The heart of the ATARR facility is the DAS. This system provides the engineers the ability to translate the voltage changes in different instruments into known, reliable engineering units. The DAS provides a context in which detailed technical questions can be answered through analysis of the basic instrumentation measurements. DAS controls all aspects of data acquisition from set-up through reduction; and, it is critical to understand the philosophy of how the system is constructed in order to best utilize its many capabilities. In a production facility, the computer system has a great deal of regimentation built into it. The test operator would not be allowed to run a test unless certain types of instruments were installed, and the number and procedures of the data reduction are limited to standard ones. Adding new reduction routines or test operations requires major changes to the computer system since there are many built-in checks to protect the test engineer from making flagrant mistakes.
DTIC
Gas Turbines; Data Acquisition; Test Facilities

19970018303 National Aerospace Lab., Aircraft Aerodynamics Div., Tokyo, Japan
Crossing Flow Control Simulations of a Ventilated Adaptive-Wall
Nakamura, Masayoshi, National Aerospace Lab., Japan; Hanzawa, Asao, National Aerospace Lab., Japan; Oct. 1996; ISSN 0389-4010; 14p; In Japanese
Report No.(s): NAL-TR-1309; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Aerodynamic interferences between an airfoil model and wind-tunnel walls cannot be avoided, therefore, the adaptive-wall concept was considered to reduce the interferences. This paper presents numerical simulations of crossing flow control at ventilated walls for a two-dimensional wind tunnel. Numerical inner and outer flows of the wind tunnel are calculated simultaneously and independently on the basis of Euler equations using a finite difference method in the Cartesian grid. The adaptive wall concept requires that the inner flow match the outer flow at the walls where the transpiration velocity is controlled. This requirement is satisfied by matching the pressure at both sides of the ventilated walls. Numerical wind tunnel tests of NACA0012 airfoil were performed to demonstrate the potential of the adaptive wall with crossing flow control. Several calculated results of airfoil abilities in the numerical wind tunnel are compared with experimental and other calculated results.
Author
Cross Flow; Wind Tunnel Walls; Airfoils; Aerodynamic Interference; Finite Difference Theory; Flow Distribution

11
CHEMISTRY AND MATERIALS

Includes chemistry and materials (general); composite materials; inorganic and physical chemistry; metallic materials; nonmetallic materials; propellants and fuels; and materials processing.

19970017907 El Dorado Engineering, Inc., Salt Lake City, UT USA

Analysis of the REEDM Computer Model's Combustion Parameters and Assumptions

Hayes, R. W., El Dorado Engineering, Inc., USA; Frandson, R. O., El Dorado Engineering, Inc., USA; The 1997 JANNAF Propellant Development and Characterization Subcommittee and Safety and Environmental Protection Subcommittee Joint Meeting; Mar. 1997; Volume 1, pp. 229-236; In English; Also announced as 19970017893; No Copyright; Avail: Issuing Activity (CPIA, 10630 Little Patuxent Pkwy., Suite 202, Columbia, MD 21044-3200 HC), Hardcopy, Microfiche

El Dorado Engineering, Inc. (EDE) was contracted by Thiokol to assist in the evaluation of the potential adverse environmental impact or adverse public health effects that could result from air emissions during combustion of solid rocket rotors. There is concern that the HCl produced from the combustion process could cause ground level concentrations in the vicinity of static firing or rocket launches that are in excess of established air quality standards. Thiokol, as a leading manufacturer of solid rocket propellant, is very interested in the continued use of solid rocket motors, but wants to assure that the use of these motors does not compromise the environment or public health EDE was tasked to perform three areas of study: (1) collect and provide all information from EDE's past efforts an measuring and studying solid propellant combustion effects on the environment; (2) evaluate the source terms, i.e., combustion products, that are used in the REEDM model; (3) evaluate the dispersion portion of the REEDM modeling. This paper covers item (2), the study of the source terms of the REEDM model. The REEDM computer air dispersion model is used by the Air Force as a tool in making decisions concerning the environmental effects associated with air emissions, of the combustion of rocket motors. EDE obtained the information used for the source terms of solid rocket motors in REEDM for evaluation, and discovered that there are apparently very significant errors in these source terms that should be called to the Air Force's attention and investigated further. Same of these apparent errors are as simple as using the wrong propellant weight and burn time; others are associated with apparently using incorrect combustion dealing with a reburning. Perhaps there is an explanation for these apparent errors, however this is not obvious, and EDE believes that there is a significant probability that serious errors are introduced into the REEDM model by using incorrect source data.

Author

Solid Propellant Rocket Engines; Burning Time; Combustion Products; Environment Effects; Propellants; Reaction Kinetics; Rocket Engines; Rotors; Solid Propellant Combustion; Solid Rocket Propellants

19970018174 Connecticut Univ., Dept. of Mathematics, Storrs, CT USA

Experimental and Theoretical Aspects of Corrosion Detection and Prevention ***Final Report, 1 Sep. 1993 - 31 Aug. 1996***

Madych, W. R., Connecticut Univ., USA; Devereux, O. F., Connecticut Univ., USA; Oct. 31, 1996; 83p; In English

Contract(s)/Grant(s): F49620-93-I-0565; AF Proj. 3484

Report No.(s): AD-A319676; AFOSR-TR-97-0007; No Copyright; Avail: CASI; A05, Hardcopy; A01, Microfiche

In addition to this summary it contains two parts consisting of various details. The experimental portion of this project is supervised by 0. F. Devereux and conducted by P. C. Su. It is devoted to the investigation of initiation and growth kinetics of corrosion in airframe alloys, including joined and protectively coated specimens. The goal is to understand fundamental mechanisms by which corrosion damage develops in order to assist in design, maintenance, and performance evaluation of airframe systems. The general investigative procedure is based on the principles of electrochemical impedance spectroscopy, EIS. The theoretical portion concerns (1) the study of a mathematical model of corrosion conducted by G. Hernandez and (2) investigation of certain algorithmic aspects of tomography and signal and image processing supervised by W. R. Madych. The objective of (1) was to determine the theoretical consequences of a well known mathematical model of corrosion in alloys and the details of obtained results were summarized in article 1 on the list which was included in the second annual report. The work associated with (2) may be briefly described as follows: In order to approximate a small portion of a cross section conventional reconstruction algorithms require the averages over all lines which pass through the entire cross section. In this work we show how certain high frequency components of a portion of a cross section can be approximated using only averages over lines which pass through or close to the region of interest. The resulting high frequency information is often sufficient for the detection of flaws, abnormalities, etc. Our method relies on the notions associated with the so-called continuous wavelet transform and the observation that Radon's classical

DTIC

Wavelet Analysis; Tomography; Kinetics; Image Processing; Corrosion Prevention; Airframes

12
ENGINEERING

Includes engineering (general); communications and radar; electronics and electrical engineering; fluid mechanics and heat transfer; instrumentation and photography; lasers and masers; mechanical engineering; quality assurance and reliability; and structural mechanics.

19970018293 Minnesota Univ., Dept. of Aerospace Engineering and Mechanics, Minneapolis, MN USA
Large Scale Turbulent Structures in Supersonic Jets ***Final Report***
Rao, Ram Mohan, Minnesota Univ., USA; Lundgren, Thomas S., Minnesota Univ., USA; Mar. 1997; 33p; In English; Sponsored in part by the Minnesota Supercomputer Inst.
Contract(s)/Grant(s): NCC2-5156
Report No.(s): NASA-CR-204496; NAS 1.26:204496; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Jet noise is a major concern in the design of commercial aircraft. Studies by various researchers suggest that aerodynamic noise is a major contributor to jet noise. Some of these studies indicate that most of the aerodynamic jet noise due to turbulent mixing occurs when there is a rapid variation in turbulent structure, i.e. rapidly growing or decaying vortices. The objective of this research was to simulate a compressible round jet to study the non-linear evolution of vortices and the resulting acoustic radiations. In particular, to understand the effect of turbulence structure on the noise. An ideal technique to study this problem is Direct Numerical Simulations(DNS), because it provides precise control on the initial and boundary conditions that lead to the turbulent structures studied. It also provides complete 3-dimensional time dependent data. Since the dynamics of a temporally evolving jet are not greatly different from those, of a spatially evolving jet, a temporal jet problem was solved, using periodicity ill the direction of the jet axis. This enables the application of Fourier spectral methods in the streamwise direction. Physically this means that turbulent structures in the jet are repeated in successive downstream cells instead of being gradually modified downstream into a jet plume. The DNS jet simulation helps us understand the various turbulent scales and mechanisms of turbulence generation in the evolution of a compressible round jet. These accurate flow solutions will be used in future research to estimate near-field acoustic radiation by computing the total outward flux across a surface and determine how it is related to the evolution of the turbulent solutions. Furthermore, these simulations allow us to investigate the sensitivity of acoustic radiations to inlet/boundary conditions, with possible application to active noise suppression. In addition, the data generated can be used to compute various turbulence quantities such as mean velocities, turbulent stresses, etc. which will aid in turbulence modeling. This report will be presented in two chapters. The first chapter describes some work on the linear stability of a supersonic round jet and the implications of this for the jet noise problem. The second chapter is an extensive discussion of numerical work using the spectral method which we use to solve the compressible Navier-Stokes equations to study turbulent jet flows. The method uses Fourier expansions in the azimuthal and streamwise direction and a 1-D B-spline basis representation in the radial direction. The B-spline basis is locally supported and this ensures block diagonal matrix equations which can be solved in O(N) steps. This is a modification of a boundary layer code developed by Robert Moser. A very accurate highly resolved Direct Numerical Simulation (DNS) of a turbulent jet flow is produced.

Author

Jet Aircraft Noise; Supersonic Jet Flow; Large Space Structures; Aerodynamic Noise; Nonlinearity

19970018323 Wright Lab., Control Analysis Section, Wright-Patterson AFB, OH USA
Control of Compressor Rotating Stall without Distributed Sensing using Bifurcation Stabilization
Sparks, Andrew G., Wright Lab., USA; Gu, Guo-Xiang, Louisiana State Univ., USA; Aug. 06, 1996; 28p; In English
Report No.(s): AD-A320147; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Control of rotating stall in axial compressors is considered. A local bifurcation stabilization theorem using the projection method for the case of an uncontrollable, unobservable critical mode is described and extended to control laws that do not vanish at the critical or bifurcation point. This result is used to derive sufficient conditions for several control laws to guarantee that the subcritical pitchfork bifurcation of an axial compressor model is made supercritical so that the rotating stall hysteresis is eliminated. Each of the control laws considers operation at a set point distinct from the critical point and depends only on annulus-averaged quantities as feedback variables to simplify sensing and signal processing requirements. The actuation considered is a bleed valve so that the control law must be positive for all possible values of the feedback variables. It is shown that positive control is stabilizing for only some of the control laws considered. In these cases, numerical examples show the transformation of the bifurcation from subcritical to supercritical and the elimination of the hysteresis region. Finally, geometric interpretations of the effects of the feedback laws in the state space are described.

DTIC

Rotating Stalls; Turbocompressors; Stabilization; Compressors; Control Theory

19970018521 NASA Langley Research Center, Hampton, VA USA

A Review of Hypersonic Boundary Layer Stability Experiments in a Quiet Mach 6 Wind Tunnel

Wilkinson, Stephen P., NASA Langley Research Center, USA; Jun. 1997; 26p; In English; 28th; Fluid Dynamics, 29 Jun. - 2 Jul. 1997, Snomass, CO, USA; Sponsored by American Inst. of Aeronautics and Astronautics, USA

Contract(s)/Grant(s): NCC1-180; NCC1-183

Report No.(s): NASA-TM-112831; AIAA Paper 97-1819; NAS 1.15:112831; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Three recent experimental studies of transition on cones with adverse pressure gradient produced by a flared afterbody and with the additive stability modifiers of wall cooling, angle of attack and bluntness are reviewed. All tests were conducted in a quiet Mach 6 wind tunnel. The dominant instability was found to be the second mode. For the cases examined with linear stability theory, the N factors at mode saturation were in the range of 8.5 to 11. Evidence of a combined second-mode/Gortler transition process was found. Mean, rms and spectral freestream data for the quiet facility is presented and the role of low frequency freestream noise is discussed.

Author

Boundary Layer Stability; Hypersonic Boundary Layer; Pressure Gradients; Angle of Attack; Cooling; Additives

19970018536 NYMA, Inc., Brook Park, OH USA

Experimental Investigation of Unsteady Shock Wave Turbulent Boundary Layer Interactions About a Blunt Fin ***Final Report***

Barnhart, Paul J., NYMA, Inc., USA; Greber, Isaac, NYMA, Inc., USA; Apr. 1997; 258p; In English

Contract(s)/Grant(s): NAS3-27186; RTOP 523-36-13

Report No.(s): NASA-CR-202334; E-10700; NAS 1.26:202334; No Copyright; Avail: CASI; A12, Hardcopy; A03, Microfiche

A series of experiments were performed to investigate the effects of Mach number variation on the characteristics of the unsteady shock wave/turbulent boundary layer interaction generated by a blunt fin. A single blunt fin hemicylindrical leading edge diameter size was used in all of the experiments which covered the Mach number range from 2.0 to 5.0. The measurements in this investigation included surface flow visualization, static and dynamic pressure measurements, both on centerline and off-centerline of the blunt fin axis. Surface flow visualization and static pressure measurements showed that the spatial extent of the shock wave/turbulent boundary layer interaction increased with increasing Mach number. The maximum static pressure, normalized by the incoming static pressure, measured at the peak location in the separated flow region ahead of the blunt fin was found to increase with increasing Mach number. The mean and standard deviations of the fluctuating pressure signals from the dynamic pressure transducers were found to collapse to self-similar distributions as a function of the distance perpendicular to the separation line. The standard deviation of the pressure signals showed initial peaked distribution, with the maximum standard deviation point corresponding to the location of the separation line at Mach number 3.0 to 5.0. At Mach 2.0 the maximum standard deviation point was found to occur significantly upstream of the separation line. The intermittency distributions of the separation shock wave motion were found to be self-similar profiles for all Mach numbers. The intermittent region length was found to increase with Mach number and decrease with interaction sweepback angle. For Mach numbers 3.0 to 5.0 the separation line was found to correspond to high intermittencies or equivalently to the downstream locus of the separation shock wave motion. The Mach 2.0 tests, however, showed that the intermittent region occurs significantly upstream of the separation line. Power spectral densities measured in the intermittent regions were found to have self-similar frequency distributions when compared as functions of a Strouhal number for all Mach numbers and interaction sweepback angles. The maximum zero-crossing frequencies were found to correspond with the peak frequencies in the power spectra measured in the intermittent region.

Author

Turbulent Boundary Layer; Shock Waves; Mach Number; Blunt Leading Edges; Fins; Flow Visualization; Static Pressure; Dynamic Pressure; Wave Interaction; Pressure Measurement

19970018587 Army Research Lab., Aberdeen Proving Ground, MD USA

A Prediction of 94-GHz Radiometer Performance in Various Environmental Conditions for Army Applications ***Final Report***

Wikner, David, Army Research Lab., USA; Sep. 1996; 26p; In English

Report No.(s): AD-A318271; ARL-TR-1103; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A prediction of 94-GHz imaging radiometer performance is made for three military scenarios in a variety of weather conditions. The scenarios considered are a ground-to-ground and an air-to-ground tank-sized target detection scenario and an aircraft landing-aid scenario. Simple models of atmospheric signal attenuation are used to calculate the scene temperature that would be present at a sensor with a 3- by 3-ft square antenna at ranges of 500 to 5000 m. This information is used to determine the range

at which scene imaging or target detection is no longer possible. It is shown that, in scenarios where tank-sized targets are involved, spatial resolution usually limits system performance before most environmental conditions do. The only exception to this is in cases of moderate and heavy rain, where the signal attenuation is quite large. Given a sensor of sufficient temperature resolution, the landing-aid scenario is shown to be a reasonable scenario, especially in foggy conditions.
DTIC
Aircraft Landing; Atmospheric Models; Imaging Techniques; Landing Aids; Weather

19970018641 Daimler-Benz Aerospace A.G., Sensorsysteme, Ulm, Germany
High Performance Data Link for Unmanned Air-Vehicles
Rochus, Wolfgang W., Daimler-Benz Aerospace A.G., Germany; Garcia, Dominique, Matra Cap Systemes, France; Nov. 1996; 10p; In English; Also announced as 19970018626; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

As a result of various system studies and work on experimental and operational Data-Links for UAV and missile applications, MATRA CAP SYSTEMS of France and Daimler-Benz Aerospace AG 'SENSOR SYSTEMS GROUP' of Germany are cooperating for the development of a high performance Data-Link for a franco-german UAV system. The organization formed for the development of this Data-link comprises a joint system engineering team for refinement of the overall data link design, definition of interface and specification of requirement to ground data terminal and air data terminal. Separate project teams in the two companies. One company responsible for ground station development, one company for development of airborne station. Maximum commonality by using identical sub-components in both stations as far as possible. Joint program direction comprising the program managers of both companies. Based on the system work, which was done in the two companies in order to win that development contract and the knowledge of previous data links which are in development or production for missile systems, the subject of data links for UAV applications is presented here.
Derived from text
Data Links; Aerospace Systems; Pilotless Aircraft

19970018784 Wayne State Univ., Inst. for Manufacturing Research, Detroit, MI USA
Thermal Wave Imaging of Hidden Corrosion in Aircraft Components ***Final Report, 1 Jul. 1993 - 30 Jun. 1996***
Thomas, R. L., Wayne State Univ., USA; Favro, L. D., Wayne State Univ., USA; Kuo, P. K., Wayne State Univ., USA; Nov. 22, 1996; 22p; In English
Contract(s)/Grant(s): F49620-93-I-0428; AF Proj. 3484
Report No.(s): AD-A318666; AFOSR-TR-96-0571; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

A program of basic research was carried out, whose objective was to make the promising qualitative thermal wave imaging NDI technique a truly quantitative tool which can have a major impact on the rapid, wide-area inspection of Air Force aircraft for hidden corrosion in aircraft components. During the program a theoretical framework was developed, based on three-dimensional scattering of thermal waves from planar subsurface defects, and the model was used to predict the images of circular subsurface defects of various radii, located at various depths from the surface of the metal. Experimental measurements on such model structures confirmed the validity of the theory and determined the parameters for applying the technique to the imaging of hidden corrosion in aircraft components. Preliminary testing of the technique was carried out on an aircraft, with corrosion being successfully imaged. Outstanding technical issues include the effects of corrosion products and other realistic thermal- boundaries which are encountered in actual aircraft structures, and the development of quantitative corrosion loss estimation algorithms.
DTIC
Aircraft Structures; Imaging Techniques; Corrosion; Nondestructive Tests; Metal Surfaces; Aircraft Maintenance; Surface Defects

13
GEOSCIENCES

Includes geosciences (general); earth resources and remote sensing; energy production and conversion; environment pollution; geophysics; meteorology and climatology; and oceanography.

19970018786 Lockheed Martin Engineering and Sciences Co., Hampton, VA USA
Documentation of Atmospheric Conditions During Observed Rising Aircraft Wakes
Zak, J. Allen, Vigyan Research Associates, Inc., USA; Rodgers, William G., Jr., Lockheed Martin Engineering and Sciences Co., USA; Apr. 1997; 42p; In English
Contract(s)/Grant(s): NAS1-96014; RTOP 538-04-11-11

Report No.(s): NASA-CR-4767; NAS 1.26:4767; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Flight tests were conducted in the fall of 1995 off the coast of Wallops Island, Virginia in order to determine characteristics of wake vortices at flight altitudes. A NASA Wallops Flight Facility C130 aircraft equipped with smoke generators produced visible wakes at altitudes ranging from 775 to 2225 m in a variety of atmospheric conditions, orientations (head wind, cross wind), and airspeeds. Meteorological and aircraft parameters were collected continuously from a Langley Research Center OV-10A aircraft as it flew alongside and through the wake vortices at varying distances behind the C130. Meteorological data were also obtained from special balloon observations made at Wallops. Differential GPS capabilities were on each aircraft from which accurate altitude profiles were obtained. Vortices were observed to rise at distances beyond a mile behind the C130. The maximum altitude was 150 m above the C130 in a near neutral atmosphere with significant turbulence. This occurred from large vertical oscillations in the wakes. There were several cases when vortices did not descend after a very short initial period and remained near generation altitude in a variety of moderately stable atmospheres and wind shears.

Author

Wind Shear; Aircraft Wakes; Vortices; Flight Tests; Meteorological Parameters

14
LIFE SCIENCES

Includes life sciences (general); aerospace medicine; behavioral sciences; man/system technology and life support; and space biology.

19970018380 National Aerospace Lab., Tokyo, Japan

In-flight Measurement of Eye Scanning Characteristics of Helicopter Pilots

Kawahara, Hiroyasu, National Aerospace Lab., Japan; Funahiki, Kohei, National Aerospace Lab., Japan; Wakairo, Kaoru, National Aerospace Lab., Japan; Tanaka, Keiji, National Aerospace Lab., Japan; Watanabe, Akira, National Aerospace Lab., Japan; Oct. 1996; ISSN 0389-4010; 15p; In Japanese

Report No.(s): NAL-TR-1310; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Attempts to study the control behaviour of helicopter pilots have been conducted with the aim of providing fundamental information for future cockpit design, establishing procedures and training. A series of in-flight measurements of human visual scanning behaviour during the following flight phases were carried out: (1) hovering, (2) level flight, (3) coordinated turning, and (4) approach and landing. A total of 12 pilots participated in the experiment, each of whom performed 16 repetitions. It was concluded from the data that patterns of visual fixation point movement can be classified into the following four categories: (1) front field + right lower field, (2) front + left lower, (3) front + right and left lower; and (4) front only.

Author

In-Flight Monitoring; Eye (Anatomy); Helicopters; Pilot Performance; Data Acquisition; Visual Observation

19970018643 Institute for Human Factors TNO, Soesterberg, Netherlands

An Exploratory Study of the Human-Machine Interface for Controlling Maritime Unmanned Air Vehicles

vanBreda, L., Institute for Human Factors TNO, Netherlands; Nov. 1996; 8p; In English; Also announced as 19970018626; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

Under contract by the Royal Netherlands Navy an exploratory study was conducted on the design of the user interface for Maritime Unmanned Air Vehicles (MUAVs) control. The goal of this study was to gain more insight into the various parameters that may influence system performance, given the present level of technology. Two simulator experiments were conducted. Results of a first experiment made clear that the image transmission rate of the downlink is a critical factor. It appeared that with a single MUAV, only combined sensor and airframe control leads to an acceptable tracking performance, in particular at short observation distances. For low sensor image update frequencies (less than 4 Hz), tracking becomes critical. Results of a second experiment revealed that the tracking performance in a MUAV supervisory control task is identical to the first experiment, even in high auditive/cognitive workload conditions. It is suggested to focus further research on ways to improve operator performance and awareness at low downlink transmission rates. This can be affected by integrating synthetic information on orientation and MUAV status into the sensor image.

Author

Man Machine Systems; Pilotless Aircraft; Human Factors Engineering; Teleoperators

15
MATHEMATICAL AND COMPUTER SCIENCES

Includes mathematical and computer sciences (general); computer operations and hardware; computer programming and software; computer systems; cybernetics; numerical analysis; statistics and probability; systems analysis; and theoretical mathematics.

19970018636 Georgia Tech Research Inst., Atlanta, GA USA
The Future for UAVs in NATO
Michelson, Robert C., Georgia Tech Research Inst., USA; Nov. 1996; 5p; In English; Also announced as 19970018626; Copyright Waived; Avail: CASI; A01, Hardcopy; A03, Microfiche

The face of NATO is changing in the light of the demise of the Soviet Block, however the need for NATO is perhaps more critical today than ever before due to the fragmented warring factions that have arisen in the absence of the stabilizing oppression of the Soviet Union and the Warsaw Pact. Unfortunately, these changes are occurring in the face of a global recession that has prompted the Nations to reconsider past levels of military spending. The demise of the Soviet Union is viewed as a reason to draw down forces and rely on existing (and sometimes antiquated) defense infrastructures. Advances in machine intelligence and robotics can be leveraged to offset the negative impact of economically-induced factors affecting the Nations' forces during the next decade. Particularly in the areas of reconnaissance, intelligence, early warning, and even certain lethal operations, the use of Unmanned Aerial Vehicles (UAV) is predicted to be a major factor in the maintenance of an affordable military presence. Law intensity conflicts along the borders of the Nations (as already witnessed in Bosnia) are expected to continue. Coupled with the need to continue certain NATO activities more effectively, is the occurrence of expanded missions that will arise due to increased trade in contraband as the Economic Community facilitates a more open Europe. Both land-based and maritime UAVs have a definite place within the NATO infrastructure, but currently the individual Nations do not have a clear or unified road map to define their use. Given a coordinated plan for the use of UAVs by the Nations, what critical technologies must be put in place over the next few years to allow UAVs to meet the challenges of the missions expected by the year 2000? How will the predicted burgeoning of the commercial market for UAVs by the year 2000 affect NATO interests in this technology, and how can NATO leverage this commercial market for its own benefit? This paper will identify both the military and commercial UAV missions expected by A.D. 2000. The analysis will consider the particular regional requirements posed by the geography of the member nations.
Derived from text
North Atlantic Treaty Organization (NATO); Artificial Intelligence; Military Operations; Pilotless Aircraft

19970018637 Austin (R. G.), Brackell, UK
Lessons Learned in the Development and Operation of Remotely Piloted Helicopters
Austin, R. G., Austin (R. G.), UK; Nov. 1996; 14p; In English; Also announced as 19970018626; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Lessons learned, both in development and operation, of rotary wing UAVs over a period of some 25 years are described. In particular it has been found that air vehicle compactness and vertical flight capability offers operational versatility not available to fixed-wing systems. There is no cost or reliability penalty to pay for this though design must take account of the dependence of the VTOL UAV on an accurate height sensor and the demands of scale (compared with manned systems) on the technology.
Derived from text
Design Analysis; Helicopters; Unmanned Spacecraft; Investigation

19970018644 METEOR Costruzioni Aeronautiche ed Elettroniche S.p.A., Finmeccanica IRI Group, Ronchi dei Legionari, Italy
Multiple UMA's In-Flight Management
Siardi, Carlo, METEOR Costruzioni Aeronautiche ed Elettroniche S.p.A., Italy; Nov. 1996; 14p; In English; Also announced as 19970018626; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Up to now significant effort has been posed in exploiting the basic UMA functionalities and operational growth potentials: almost all issues concerning single UMA employment are currently being addressed and solutions are due to come. Instead, Multiple UMA's control and operational Management (MUM) is still an open issue which has to pass through accurate and comprehensive operational scenarios evaluation and thus ending up with proper requirement definition. The present paper deals with this latter statement, also trying to outline potential problems which may arise operationally. Among the many parameters involved, timing is going to be the key parameter to handle, in order to allow full UMA utilization within multi-forces operations. As far as multiple UMA's controlled by a single GCS are concerned, this issue can be translated in how accurately the time windows tied to each navigational waypoint are intercepted by the in-flight air-vehicles. Therefore the question moves to which parameter must be controlled by the UMA Flight Management System and how is it influenced by the en-route wind. Another intriguing subject is closely connected to the link band employed: provided satellite links represent a viable and effective solution, we hereon

limit are discussion to conventional ground links. In case of NATO standard J-Band link a narrow beam is necessary due to the band typical fading margin and energy losses. Since a GCS has to cope with several UMA's performing their missions, an accurate trade-off must be conducted to establish a proper balance between several basic parametric constraints, such as ground antenna beam width, spatial air-vehicle navigational accuracy, Ground Data Terminal antenna stabilization, GCS Man Machine Interface and so on, in order to guarantee a reliable air-vehicle acquisition for proper tracking and data gaining. Moreover, link loss and failures management during silent flight are going to be tough subjects to cope with, for they represent potential hazards within airspace control activities. Last but not least is how to demonstrate the fullfillment of the requirements, keeping an eye on testing costs and risk reduction.
Author
Antenna Radiation Patterns; Communication Satellites; Data Links; Flight Control; Flight Management Systems; Man Machine Systems; Superhigh Frequencies

19970018645 Instituto Superior Tecnico, Lisbon, Portugal
ARMOR Project: Autonomous Flight Capability
Lourtie, P., Instituto Superior Tecnico, Portugal; Azinheira, J. R., Instituto Superior Tecnico, Portugal; Rente, J. P., Instituto Superior Tecnico, Portugal; Felicio, P., Instituto Politecnico de Setubal, Portugal; Nov. 1996; 12p; In English; Also announced as 19970018626; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

Unmanned Aerial Vehicles have a definite potential for civilian observation and reconnaissance missions such as forest fire detection or coastal waters surveillance. For a decision to use such vehicles in significant numbers to be taken, once the adequate legal framework is defined, they must be easy to operate at a low cost. The ARMOR project aims at developing such a vehicle. The ease of operation requires that the vehicle is sufficiently autonomous to perform most of the mission without the contribution of an experienced pilot. To achieve this degree of autonomy it must have a reliable Vehicle Management System (VMS) capable of dealing with both normal and anomalous situations. A structure for the VMS is presented and the work being done in fault detection is presented. The vehicle will have to be extensively tested, increasing progressively its complexity, starting with a simple guidance system and finishing with the full VMS. This means that the guidance system is one of the first to be developed. The work being done for this system is also presented. The guidance system has to be highly reliable but simple for low cost. For the types of operation envisaged, precision is not a very stringent requirement. As a whole, simplicity induces lower costs but also lower precision. One of the objectives of the work being done is to define the minimum amount of information on the flight path compatible with guidance system efficiency. Some of the results obtained so far are shown and discussed.
Author
Autonomy; Pilotless Aircraft; Cost Reduction

19970018649 Thomson-CSF, Div. Systemes Missiles, Bagneux, France
Automatic Alerting System to Counter Low and Very Low Altitude Antiship Missiles ***Systeme d'Alerte Autonome Deporte Contre Missiles Antina Vires Basse et Tres Basse Altitude***
Fesland, S., Thomson-CSF, France; Nigron, P., Thomson-CSF, France; Subsystem Integration for Tactical Missiles (SITM) and Design and Operation of Unmanned Air Vehicles (DOUAV); Nov. 1996; 12p; In French; Also announced as 19970018626; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The system for alerting naval personnel in the defense of surface vessels against low and very low missiles is described. It is supported by the original concept of premature warning using automatic unmanned aerial vehicles (UAV). A command logic for each UAV which accounts for different constraints (no collision with other UAVs, displacement of the surface vessels) is presented. It uses the theory of fuzzy logic. An informative simulation accomplished by THOMPSON-CSF permits obtaining results which prove the concept to be very promising. The results and various proposals are presented.
Transl. by SCITRAN
Pilotless Aircraft; Antiship Missiles; Systems Engineering; Early Warning Systems; Low Altitude

19970018651 Societe d'Applications Generales d'Electricite et de Mecanique, Paris, France
CRECERELLE: A New Generation System of Quick Remote Control for Reconnaissance, Surveillance and Acquisition of Objectives ***CRECERELLE: Un Systeme d'Avion Leger Telepilote de Nouvelle Generation, pour des Missions de Reconnaissance, de Surveillance et d'Acquisition d'Objectifs***
Thin, G., Societe d'Applications Generales d'Electricite et de Mecanique, France; Durieux, P., Societe d'Applications Generales d'Electricite et de Mecanique, France; Subsystem Integration for Tactical Missiles (SITM) and Design and Operation of Unmanned Air Vehicles (DOUAV); Nov. 1996; 8p; In French; Also announced as 19970018626; Copyright Waived; Avail: CASI; A02, Hardcopy; A03, Microfiche

The unmanned aerial vehicle (UAV) system CRECERELLE for reconnaissance, surveillance, and acquisition of targets, conceived and developed by the SAGEM group is in operation with the 7th Artillery Regiment. In numerous aspects, the system departs from the characteristics of previous systems. This departure is the result of new operational exigencies and a new geopolitic context which leads to the development of a primary system of robot reconnaissance based on recent technologies. The CRECERELLE system has been conceived as being in first place as a method for collection and processing of schematic information composed of a central unit - the ground station- associated with the gathering and processing of information and dissemination to fields of conflict. This equipment, representative of the advanced technologies developed for CERCERELLE, is described in this article. Transl. by SCITRAN

Pilotless Aircraft; Remote Control; Aerial Reconnaissance; Target Acquisition; Surveillance; Robots

19970018652 General Atomics Co., San Diego, CA USA

PREDATOR: Medium Altitude Endurance

Ernst, Larry, General Atomics Co., USA; Nov. 1996; 14p; In English; Also announced as 19970018626; Copyright Waived; Avail: CASI; A03, Hardcopy; A03, Microfiche

The design, development and performance of a state-of-the-art UAV and ground control station is presented. Technological areas discussed include: The endurance, performance, and multi-frequency data link of Tier-1 Tactical Endurance UAV; payload, SAR all-weather capability, satellite control, and GPS & INS of TIER-2 Medium Altitude Endurance UAV; performance, payload, and line-of-sight data link and autonomous flight of Joint Tactical UAV maneuver variant; and State-of-the-art common ground control station.

CASI

Pilotless Aircraft; Aircraft Design; Remotely Piloted Vehicles; Ground Based Control; Aircraft Performance

Subject Term Index

W

Y

Personal Author Index

S

T

V

W

Y

Z

Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
NASA SP-7037 (352)		

4. Title and Subtitle	5. Report Date
Aeronautical Engineering A Continuing Bibliography (Supplement 352)	July 11, 1997
	6. Performing Organization Code

7. Author(s)	8. Performing Organization Report No.
	10. Work Unit No.
9. Performing Organization Name and Address	
NASA Scientific and Technical Information Program Office	11. Contract or Grant No.

12. Sponsoring Agency Name and Address	13. Type of Report and Period Covered
National Aeronautics and Space Administration Langley Research Center Hampton, VA 23681	Special Publication
	14. Sponsoring Agency Code

15. Supplementary Notes

16. Abstract

This report lists reports, articles and other documents recently announced in the NASA STI Database.

17. Key Words (Suggested by Author(s))	18. Distribution Statement
Aeronautical Engineering Aeronautics Bibliographies	Unclassified – Unlimited Subject Category – 01

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	44	A03/HC

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